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EARLY DEVELOPMENTS IN A SUBALPINE LODGEPOLE PINE STAND OF FIRE ORIGIN

GENERAL SCIENCES
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BY
K. W. HORTON

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Forest Research Division
Technical Note No. 16
1955

Published under the authority of
The Minister of Northern Affairs and National Resources
Ottawa, 1955

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Early Developments in a Subalpine Lodgepole Pine Stand of Fire Origin*

PROJECT K-4

BY

K. W. HORTON

Lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) is the subclimax dominant of Alberta's subalpine forest, and its early ecological development is of primary silvicultural interest. To extend our knowledge in this connection, the density and growth trends of a young pine stand were followed yearly on permanent sample plots (4) representing good and poor site conditions. The stand, located on the Kananaskis Forest Experiment Station, became established after a fire in 1936.

Two plots of two acres each were selected for the study on the basis of contrasting conditions. Plot 1 is situated on a moderately good site, an east-facing slope. It was formerly stocked with a 200-year-old pine-spruce stand, and is currently overstocked with pine regeneration. In contrast, Plot 2 is located on a poor site, an xeric bench. The former stand was comprised of dense, 70-year-old pine, and the regenerated pine stand is lightly stocked. In each plot, five strips designated A to E, each 3·3 feet by 132 feet in dimensions, were used to tally the density and height of the regeneration annually.

Figure 1 shows the population trends of pine over the 17 years since initial establishment. The higher density of Plot 1 is assumed to result mainly from superior site. A related study in the same burn substantiates this point (3). As would be expected, the heavily stocked Plot 1 has begun to thin out considerably compared with the more lightly stocked Plot 2, which has been remarkably stable at about 6,000 trees per acre. The occasional upward trend in number of trees in both plots may be explained by the fact that some seeding-in will occur for several years after the initial stand establishment (3). This tends to counterbalance natural mortality and thereby stabilize the density. Moreover, many of the suppressed trees are able to survive extreme competition for a long time, thus continuing the overstocked condition. Rabbit browsing appeared to be an influential factor in killing off many suppressed pines in the denser areas. Another minor biotic thinning agent noted was the blister rust (*Cronartium commandrae* Pack), which caused sporadic mortality in the young pines through lower-stem cankers.

Figure 2 depicts the annual maximum height growth trends of pine for each strip. Several points are worthy of note. The greater heights in Plot 1, despite greater densities, emphasize again its superiority in site over Plot 2. As might be expected, the most heavily stocked of all the strips, 1A, had the greatest retardation in height growth in recent years. The strip located on the poorest site, 2E, steadily showed the lowest maximum height development. Strip 2B

*This study was initiated by H. A. Parker, retired.

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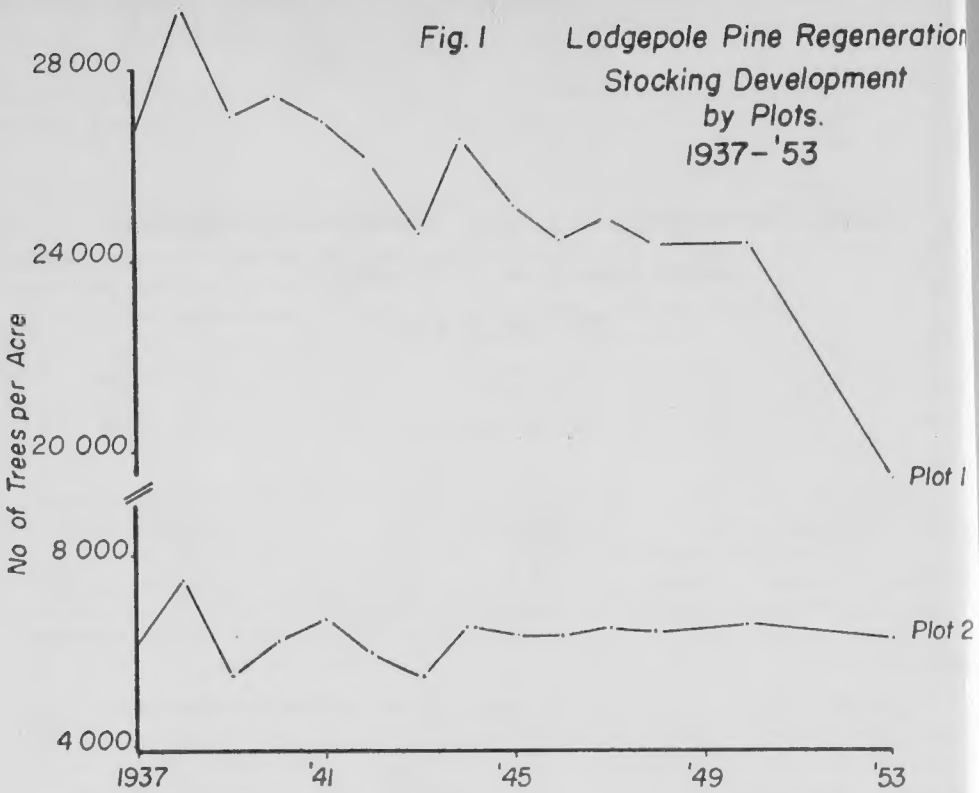
Fig. 1
Lodgepole Pine Regeneration
Stocking Development
by Plots.
1937-'53
28 000
24 000
20 000
8 000
4 000
No of Trees per Acre
Plot 1
Plot 2
1937
'41
'45
'49
'53

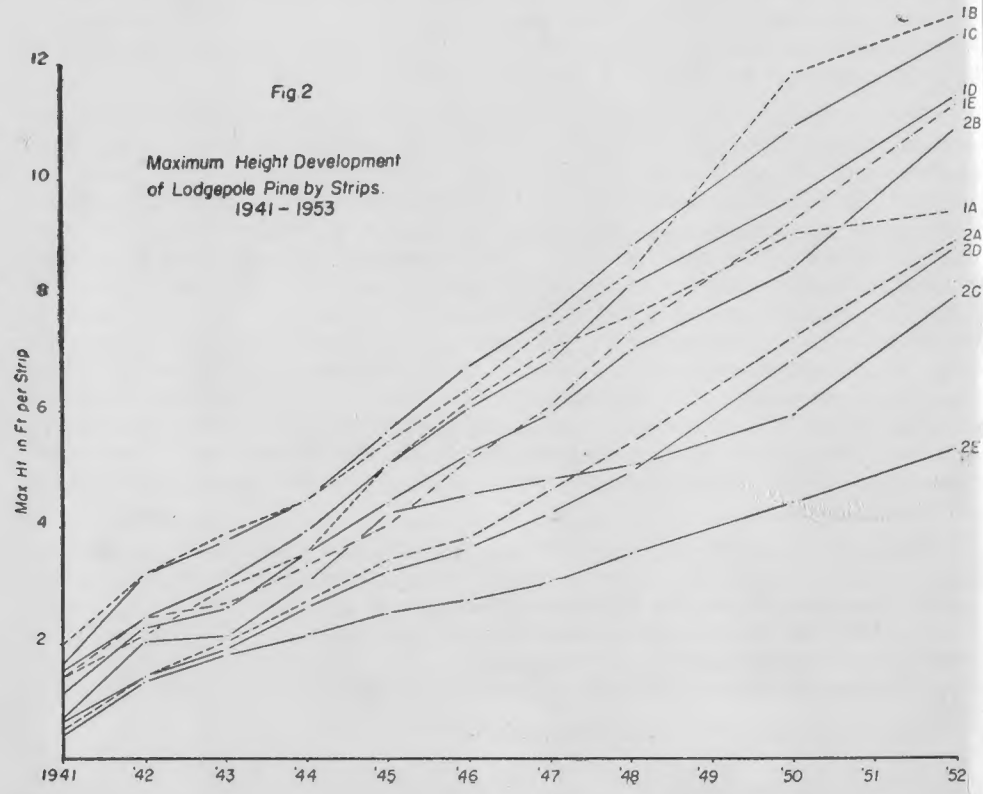
Fig 2
Maximum Height Development
of Lodgepole Pine by Strips.
1941 - 1953
12
10
8
6
4
2
Max Ht in Ft per Strip
1941
'42
'43
'44
'45
'46
'47
'48
'49
'50
'51
'52
1B
1C
1D
1E
2B
1A
2A
2D
2C
2E

on the best site in the lighter stocked Plot 2 was favoured with a greater maximum height increase in the last few years than any other strip, which reflects the combined result of comparatively good stocking and site.

The density development of other species through the 17 years in the regenerated plots is shown in Figure 3. Aspen (*Populus tremuloides* Michx.) became established quickly and in abundance before the pine had formed a complete canopy, but died off almost as quickly as the coniferous competition increased. It cannot compete favourably with the conifers on these podsolized mountain slopes. The steadily increasing amount of spruce (*Picea glauca* (Moench) Voss var. *Albertiana* (S. Brown) Sarg.) and the slow but persistent initial establishment of alpine fir (*Abies lasiocarpa* (Hook.) Nutt.) corresponds with the generally accepted concept that these species will eventually succeed lodgepole pine to become the climax dominants (1, 2).

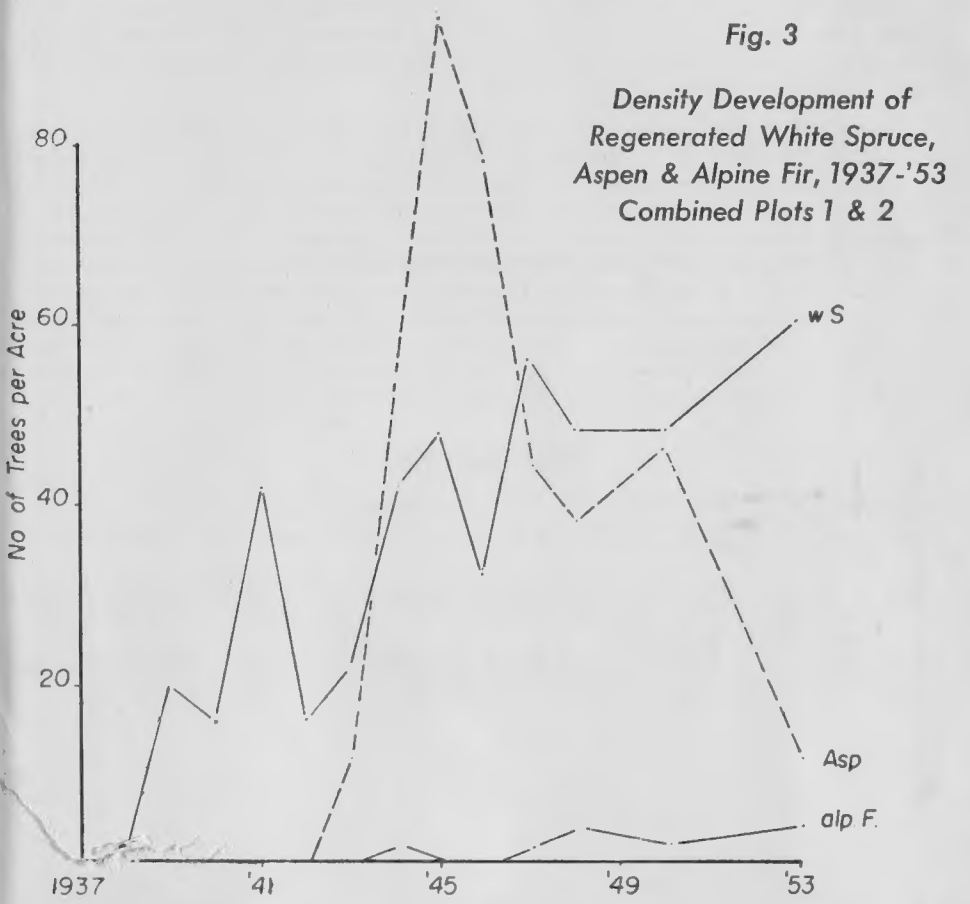

Fig. 3

Density Development of Regenerated White Spruce, Aspen & Alpine Fir, 1937-'53 Combined Plots 1 & 2

The strips within Plot 2 varied sufficiently in site quality to show a correlation between site and both height growth and density. Using depth of the topsoil as the chief criterion, and omitting strip 2A which is inconsistent as to soil type, the strips fall into a comparatively definable site pattern as shown below.

Strip No.	Depth to Gravelly C Horizon	Average Height 1950	Maximum Height 1950	No. of 1P 1950
2B	13″ +	4·6′	8·5′	105
2D	10–14″	3·5	6·9	62
2C	9–12″	2·6	6·0	81
2E	9–10″	2·8	4·5	28

Strip 2B lies near the base of a moderate, east slope, where the soil is deeper and less stony than elsewhere. Most of the spruce seedlings on Plot 2 occur here, a significant point considering the mesic propensity of spruce. Thus 2B has the best site conditions in Plot 2. In contrast, 2E has the shallowest topsoil and is close to the brink of a steep slope, conditions which suggest it as the poorest site. These two extremes emphasize the direct relationships which seem to exist between site, density, and both maximum and average height. Where density is not so great as to retard height growth, the better the site, the greater the density and height growth appear to be.

Though of limited scope, the information provided by this study is of value in the applied silviculture of this type. It is recognized that better early height growth occurs where favourable site and stocking conditions exist. If thinning could be economically justified in lodgepole pine stands, the best sites, which are generally more densely stocked, should receive priority. It should be carried out early to maintain maximum height increment and to eliminate the suppressed trees which survive a long time and thereby contribute towards extended overstocking. The aspen on the slopes may be ignored, since it disappears through competition with the conifers. The spruce understory content will continue to increase for many years after the initial stand establishment, a tendency which should be considered in the silviculture of these stands.

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	Maximum Height 1950	No. of 1P 1950
2B.....	8·5′	105
2D	6·9	62
2C.....	6·0	81
2E.....	4·5	28

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